

REMARKS

Claims 1 and 4-11 are presently pending in the application.

At the outset, Applicants wish to thank the Examiner for the courtesy of the personal interview at the U.S. Patent and Trademark Office on October 10, 2003, extended to Applicant's undersigned attorney and Applicant's representative Mr. Teruhisa Kanbara from the Intellectual Property Department of Matsushita Electric Industrial Co., Ltd., the Assignee of the above application. At the interview, claim 1 was discussed, essentially as set forth above, with the exception of one clause which has now been removed to dependent claims 9-11, as discussed in more detail below. The Examiner agreed that the claim amendment distinguished over the prior art currently of record, but indicated that it would be necessary to update the search for the newly added features after Applicants submit the present formal Amendment with an RCE Request. The substance of the interview is summarized and supplemented in the below Remarks.

As indicated at the interview, several dependent claims have been added, depending directly or indirectly from claim 1. Support for the claim amendments may be found as follows: the added clause to claim 1 is supported, for example, in Example 1 of the application, particularly in the description of the production of the internal humidifier, starting at the middle of page 10 of the specification; support for claim 4 may be found, for example, at page 10, lines 11-12 and page 14, lines 5-8; support for claims 5 and 6 may be found, for example, at page 7, second full paragraph; support for claim 7 may be found, for example, at page 10, last two paragraphs and page 12, second full paragraph; support for claim 8 may be found, for example, at page 10, lines 15-16; and support for claims 9-11 may be found, for example, in original claim 1 and at page 5, 1st full paragraph.

As explained at the interview, the polymer electrolyte membrane, which is used in both the total heat exchanger of the present invention and in the reaction gas humidifier used in JP'038 of Fuji Electric Co., Ltd. tends to swell by absorbing water from the wet exhaust gas stream, so that it expands and becomes misshapen. In the case of the humidifier of JP'038, as shown in Fig. 1 of the reference, the vapor permeation film 12 (polymer electrolyte membrane) spans the center of the reaction gas humidifiers 11 and 21, thereby defining open chambers 13 and 14 for flow of the humidification (exhaust) gas and the gas to be humidified (reaction gas). As a result of the deformation of the film 12 upon absorption of water, the misshapen film tends

to block or partially block the flow path of the gas supply streams to and from the fuel cell, thus impairing the feed of the reaction gases and/or the humidification by the exhaust gases.

In contrast, with the present invention, while the polymer electrolyte membrane will still swell and deform upon absorption of water, the deformation of the membrane is controlled and contained between the two sheets of carbon paper placed on either side of the membrane and sandwiched between two plates. As a result, the flow paths for the reactant gases and exhaust gases through the total heat exchanger remain open to the passage of gas on either side of the membrane and allow water vapor to be exchanged across the membrane.

The sheets of carbon paper on either side of the membrane in the total heat exchanger are neither shown nor suggested by JP'038 nor the other prior art of record. Both JP'924 and EP'357 show different types of humidifiers from the present invention. Thus, both JP'924 and EP'357 disclose humidifiers which use liquid-gas (i.e., water-gas) heat exchangers, in which cooling water is used to supply the gas with humidity, in contrast to the humidifiers of JP'038 and the heat exchanger of the present invention, in which the exchange of heat and humidity are on a gas-gas bases. The disadvantages of water-gas humidifiers are discussed, for example, at the middle two paragraphs of page 6 of the present specification. In any event, neither JP'924 nor EP'357 discloses or suggests sheets of carbon paper on either side of the membrane. Accordingly, reconsideration and withdrawal of the rejection in the final Office Action are respectfully requested.

The Examiner agreed that the above added feature of the amended claim 1 was not shown or obvious from the prior art of record, but that further searching for this feature would be necessary. With respect to the deleted features from claim 1, it is not required that the polymer electrolyte membranes be the same or identical for both the fuel cell and the heat exchanger. Thus, it is only necessary that they be similar in their properties, e.g., allowing the passage of water but not hydrogen gas (see, for example, page 4, line 2 and page 8, line 1 of the present specification). Similarly, it is not necessary, but preferred, that the heat exchanger be located between the end plates or other designated positions in the fuel cell, and the various mentioned locations have been separated and moved to new claims 9-11.

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Amendment Accompanying RCE Request

In view of the above Amendments and Remarks, it is submitted that all of the claims in the application patentably distinguish over the prior art of record. Accordingly, reconsideration and an early Notice of Allowance are respectfully solicited.

Respectfully submitted,

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